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Comparative advantage and pathways to financial development: Evidence from Japan's silk-reeling industry

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Comparative advantage and pathways to financial development: Evidence from Japan's silk-reeling industry*

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Abstract

We exploit the natural experiment of Japan's opening to international trade to examine how comparative advantage can shape a country's long-run path towards financial development. In the late 19th century, many of Japan's prefectures had a natural comparative advantage in silk reeling. Producing silk for export required access to finance. At the same time, for technological reasons, borrower-quality in the silk reeling industry was notoriously hard to assess. Silk exporters overcame these frictions by forming local cooperative banks. We show that in the ancient silk prefectures, local cooperative banks continued to dominate local banking markets for over a century while bigger, country-wide banks came to dominate in other regions. By the late 20th century, the silk prefectures are indistinguishable from other regions in terms of their general level of financial development. However, our results suggest that they were effectively less financially integrated with the rest of the country. Hence, comparative advantage in silk favored the emergence of a banking-system dominated by small relationship lenders. But due to the local nature of these lenders, it also caused long-term geographical segmentation in banking markets.

JEL-Codes: F15, F30, F40, G01, N15, N25, O16
Key Words: Comparative advantage, financial development; financial integration; Japan; banking history, trade credit; export finance; silk industry: relationship lending

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1 Introduction

The impact of financial development on international trade has been widely documented in the economic literature. However, much less attention has been given to the question to what extent comparative advantage affects financial development and the degree of financial integration of a country or region into the world economy. In this paper we shed new light on this question, exploiting the historical opening of Japan for international trade as an identifying shock.

After Japan's opening to trade in the 19th century, silk thread emerged as Japan's first export staple. We show that the specific financing needs of the silk reeling industry led prefectures with a natural (i.e. exogenous) comparative advantage in silk reeling to embark on a pathway to financial development in which small, cooperative banks came to dominate local lending markets. As we discuss in detail, this happened because silk filatures were particularly dependent on external finance while at the same time requiring special screening abilities from lenders. This favored the development of small cooperative lenders focused on relationship-based lending. Conversely, regions with comparative advantage in other industries developed a banking system dominated by bigger, regionally integrated banks that operate at arm's length.

We show that these different pathways to financial development had a very persistent impact on the structure of Japan's banking markets. Specifically, we document that silk regions still had higher market shares of local cooperative banks a century later, during the 1980s, at the onset of Japan's "lost decade". This meant that the particular pathway to financial development on which a prefecture embarked depending on its comparative advantage in 1895 affected how integrated its banking system was into Japan's nationwide banking market a century later, in 1990. Importantly, our results do not suggest that the silk-regions were generally financially less developed in the late 20th century. In fact, in all standard-measures of financial development such as credit-to-GDP ratios or the number of bank branches, we find the silk regions to be indistinguishable from the rest of the country. Rather, silk prefectures differ from the rest of the country mainly in terms of their banking structure and, thus, in their de facto degree of regional financial integration.

Our results shed new light on the interdependency between financial development and financial integration: comparative advantage affected the pathways to financial development, not the ultimate level of financial development itself. However, different pathways had a century-long impact on the degree to which prefectures were effectively financially integrated when the Japanese bubble burst in the early 1990s. During Japan's industrialization, large-scale bank finance was extremely important in developing other industries—cotton reeling, railways, steel milling and coal mining—whereas the main silk reeling areas achieved economic growth through financial development based mainly on small, often cooperatively owned banks. While this model certainly served the needs of the silk industry very well, it eventually led to a long-lasting regional fragmentation of the banking system that persisted for over a century. As we argue in a companion paper (Hoffmann and Okubo 2021), these regional differences in the level of financial integration, in turn, then had a considerable impact on small firms' access to finance during the crisis and on post-crisis growth differentials between prefectures.

Contribution to the literature

Our paper is most closely related to the findings by Do and Levchenko (2008), who show that export structure may be an important determinant of financial development: countries with a comparative advantage in industries with high external finance dependence will ultimately develop a financial sector that is suited to sustaining these industries, whereas countries specializing in industries with low external finance dependence will have lower financial development. Our findings are consistent with Do and Levchenko (2008) in that the silk regions developed financial institutions that helped them exploit their specific comparative advantage. However, we differ from Do and Levchenko (2008) in that our results do not allow us to conclude that this led to higher or lower levels of financial development in the long-run. Rather, the specific financial institutions that developed to overcome the specific financing frictions of the fragmented silk reeling industry —local cooperative banks— contributed to making these regions effectively financially less integrated with the rest of the country even a century later.

Our analysis heavily relies on earlier literature showing that Japan's opening to trade was indeed a natural experiment. Bernhofen and Brown (2005, 2004) demonstrate that this opening spurred the development of industries in which Japan had a comparative advantage, with the silk industry as a preeminent example. The role of special institutions involved in trade credit and export finance for the development of the silk industry has been explored by several scholars of Japanese economic history (e.g. Nakabayashi (2001) and Miwa and Ramseyer (2006)).[1] However, to our knowledge, we are the first to identify the persistence of the role of these institutions, and that it led to a regional segmentation in banking markets that lasted for over a century. In explaining these differences in banking market structure, we also relate to recent literature that has emphasized the role that trade credit can play in attenuating informational asymmetries (Petersen and Rajan (1997)) and in overcoming barriers to growth in environments with low financial development (Fisman and Love (2003)). As we discuss in more detail below, most silk reeling firms were located in remote prefectures and were unable to borrow directly from the banks in the big port cities. Instead, the Yokohama silk merchants who sold the silk to the international market also effectively provided trade credit to the reelers. In the longer run, only mechanized reelers were able to provide the consistently high quality of silk required by international markets (in particular the US). Therefore, only the prefectures in which there was a high concentration of reeling firms (and in which these firms switched to mechanized production quite early) could keep their competitive advantage, and these eventually became the main silk-exporting regions. Furthermore, with Yokohama as the export hub, eventually only regions that were able to export internationally enjoyed continued access to the particular form of nonbank credit provided by the Yokohama silk merchants.

There are a number of explanations of why the silk industry had such a long-lasting effect on Japan's regional banking landscape. First, the specific type of regional bank that emerged in the silk

[1] The terms 'trade credit' and 'trade finance' are ambiguous in the literature. We follow Amiti and Weinstein (2011) and use the term 'trade credit' to denote financing by suppliers (e.g. by allowing deferred payment of materials). By contrast, the term 'trade finance' refers to the financing of international trade. As we argue below, both concepts are relevant in understanding the development of the institutions financing the silk trade. To further facilitate the distinction between the two concepts, in the remainder of the paper we do not use the term 'trade finance' but instead refer to financing of international trade as 'export finance'.

regions served its purpose well: scholars of Japan's economic and social history have noted that these institutions—many of them organized as cooperatives—successfully resolved the financing frictions faced by the fragmented silk industry, whereas big national banks tended to cater to the financing needs of large-scale, capital-intensive industries such as cotton reeling, railroads and heavy industry (see Miwa and Ramseyer (2006)). As the silk industry remained the foremost export industry until the onset of World War II, it is not surprising that its small-scale, regional institutions shaped Japan's banking landscape well into the 20th century—in fact, until after the war.[2] Regulation during the interwar years was deliberately targeteed at limiting local competition and consolidation only took place along regional lines (Hoshi (1995),Okazaki and Sawada (2007)). Heavy regulation of Japanese banking in the post-WWII era—the 'convoy system' and separate legal frameworks for Shinkins (industrial and commercial cooperative banks) and Sogo (mutual) banks—then consolidated this *de facto* separation of regional banking markets for at least the next 40 years.

The remainder of this paper is structured as follows. Section 2 presents the data. Section 3 provides historical background on the role of the silk reeling industry for Japan's financial development. Section 4 presents our key results on the persistent, century-long impact of silk reeling on regional banking market structure and discusses in what respect the emergence of silk was truly exogenous with respect to Japan's financial development. Section 5 focuses on the likely reasons for the persistent impact of silk on banking market structure and on potential confounders. Section 6 offers concluding remarks.

2 Data

All our data are at the prefectural level. There are 47 prefectures in Japan. We drop Okinawa prefecture, which had a special status as a US territory until the early 1970s and still remains economically separate from the mainland in many ways. Hence, there are 46 prefectures in our sample.

[2]This is plausible because the regional distribution of economic activity remained remarkably stable after the war (see Davis and Weinstein (2002)).

Historical data Prefectural borders in Japan have remained largely unchanged since the early 1890s. This will allow us to directly correlate 19th century prefecture-level with their counterparts from the late 20th centuey. Our data on the number of silk filatures in the late 19th century are taken from *Zenkoku Seishi Kojo Chosa* (*Survey of Silk-reeling Factories throughout Japan*). Filatures are classified by whether they used mechanized-reeling or hand-reeling equipment and by total production per year (again: by machines, by hand and in total), all at the prefecture level. We use data from the earliest available year, which is 1895. The largest, most important silk prefectures by output are Nagano and Gifu, followed by Aichi, Kyoto and Yamanashi. Prefecture-level data on population in 1895 are from the *Nihon Teikoku Minseki Kokouhyo* (*Registered Household Tables of Imperial Japan*).

Measuring regional segmentation in Japan's modern banking markets Japan's banking market is tiered along regional lines (Hoshi and Kashyap (2004); Kano and Tsutsui (2003)). The big mega- or city banks and the so-called first-tier regional banks usually operate country-wide or at least in several prefectures They therefore integrate local banking markets across prefectural boundaries.

By contrast, truly local banks in Japan fall into two main groups: mutual banks (Sogo banks, also often referred to as second-tier regional banks) and industrial credit associations (Shinkins). By their statutes, these banks are mostly organized as cooperatives that, from the outset, were set up to provide finance to local small businesses in the manufacturing sector. Client SMEs usually also are members of these associations or cooperatives and many local banks, in particular the Shinkin, have explicit size caps (in terms of revenue or employment) on the membership firms. As we discuss and show below, the origins of these local banks can be linked to the development of the silk industry in the late 19th century. Since both the Shinkin and the Sogo banks also have designated, statutory areas of operation, they can be considere as genuinely local banks.

We turn to the *Economic Statistics Annual by Prefecture* by the Bank of Japan to obtain prefecture-level data on bank lending by bank type (City and first-tier regional bank, Sogo banks, Shinkin, other bank types). We propose to measure regional banking integration in the 1980s by the share of city

banks in total prefecture-lending in the 1980s. Alternatively, we consider the share of Sogo and Shinkin banks in total lending as an indicator that is negatively associated with financial integration.[3]

Other modern-day data Nominal prefectural GDPs for the 1980s are taken from the *Annual Report on Prefectural Accounts* (Cabinet Office of Japan). We obtain per capita values using population data from the same source. We deflate using the countrywide consumer price index, obtained from the Ministry of Internal Affairs and Communications of Japan. The importance of small manufacturing firms in terms of employees and value added at the prefectural level is taken from the *Manufacturing Census of Japan* by the Ministry of Economy, International Trade and Industry. We define small and medium manufacturing enterprises (SMEs) as having fewer than 300 employees.

3 Regional financial development in Japan: the role of silk reeling

The opening of Japan's ports for trade following the Harris Treaty of 1858 was an exogenous event that led to the emergence of silk thread as Japan's first and (until the onset of World War II) foremost export good.[4] The international circumstances of Japan's entry into the world market for raw silk were propitious. Silkworm pests had severely reduced French and Italian silk output by the mid-19th century. The opening of the Suez Canal also substantially increased access to European markets. Furthermore, and most importantly, the increased industrialized use of silk in the US had opened up a new market on the other side of the Pacific (see Federico (1997) and Li (1982)).[5]

[3] The former is not exactly equal to one minus the latter because there are also othery types of banks (e..g. the postal office or smaller agricultural cooperatives).

[4] Bernhofen and Brown (2005, 2004) argue very convincingly that Japan's opening was a natural experiment and that the specialization in silk reflected a comparative advantage.

[5] While China was historically the leading producer of silk, with its best produce outstripping Japanese silk in quality, Japanese innovations in sericulture in the late Tokugawa period and the emergence of cooperative structures to ensure quality, provide credit and assist in the purchase of machinery (to be discussed below) soon put Japan in a position to provide silk of very consistent quality to the world market. This standardization in quality proved a particularly important competitive advantage for Japan, as silk weaving became increasingly industrialized, in particular in the US (Li (1982)). Note also that the US maintained high tariffs on woven silk but strongly depended on imports of silk thread for its weaving

Unlike other industries that started to emerge with the opening of the treaty ports, e.g. cotton mills and machinery, the silk industry was highly fragmented—and largely remained so until its decline on the eve of World War II. While sericulture had started to spread throughout Japan during the Tokugawa period, the mountainous areas of central Japan were climatically best suited for raising silkworms. This initially led sericulture to be particularly concentrated in these areas. In the early days, silk growing and reeling was largely a cottage industry, with farmers who grew the cocoons also reeling the silk.

The reeling of cocoons was initially largely done by hand. As described in Nakabayashi (2006), the French depression of the 1880s changed this. France had traditionally been a market for hand-reeled silk. The depression therefore led to a huge decline in the price of hand-reeled silk, whereas demand for machine-reeled silk exploded in the US, leading to a huge relative price increase for the latter. The reason for this shift in demand from hand-reeled to machine-reeled silk was that the US market—as the first mass consumer market for silk products—required industrial-scale quantities of silk thread of very consistent (though not necessarily the highest) quality. Only thread of such consistent quality could be woven on mechanized looms. Furthermore, the consistent quality of the thread, in turn, could mainly be achieved through a mechanized reeling process (Nakabayashi (2006)).

The need for increased mechanization accelerated the separation of silkworm farming and silk reeling. This was the case for two reasons. First, though not particularly capital intensive, mechanization required *some* capital, which not all small hand reelers could raise (Nakabayashi (2006) and Miwa and Ramseyer (2006)).[6] Second, and most importantly for this paper, the separation of reeling and cocoon growing made it necessary for reelers to purchase cocoons. This required access to working capital: cocoons had to be bought in the spring, but the reeled raw silk could only be shipped to the Yokohama market toward the end of the summer. Hence, filatures strongly depended on credit for working capital. In fact, the purchase of cocoons accounted for up to 80 percent of the annual

factories. Hence, it was reeled silk thread that became Japan's main export staple.

[6] Many farmers who had previously also reeled silk by hand would now specialize in the growing of cocoons. The shift in demand led to an expansion of sericulture to all parts of Japan. Gradually, infrastructure improved and railways made possible the quick transport of cocoons over large distances by the late 1880s.

operating costs of a filature (see e.g. Federico (1997)).

We argue that this need for credit, which was brought about by the separation of sericulture from the increasingly mechanized process of silk reeling, had a considerable impact on regional financial development. Smaller filatures were largely unable to borrow from the new, western-style banks that had started to emerge soon after the opening of the country in the 1870s and 1880s. Located mainly in the big cities such as Yokohama, Osaka or Tokyo, these banks found it difficult to assess borrower quality among the small silk reeling firms, most of which were located in remote and inaccessible parts of the country.[7] A key role was therefore played by the Yokohama silk brokers, who not only acted as intermediaries between the international market for silk thread (largely based in Yokohama, as foreigners were not allowed to travel the country by themselves) and the reelers, but also organized the whole production and marketing chain. Importantly, these brokers had detailed knowledge of market conditions in Yokohama. They also travelled to the silk regions frequently and therefore had an informational advantage when it came to knowledge of local conditions in the silk reeling areas and the borrower quality of small silk reeling firms. It were these silk brokers who extended trade credit to small filatures so they were able to buy cocoons. The growing financing needs of the silk business soon also led to the emergence of the first local banks. Often, these banks were founded by silk reelers' cooperatives and/or with the help of the Yokohama merchants. However, these banks did not effectively raise the capital required for the loans from outside the region. Rather, it was the Yokohama silk merchant who effectively raised the capital for the loan to the silk reelers in the Yokohama market. Nakabayashi (2001) details the working of this system of silk finance as follows. A silk reeling firm would promise to sell its entire production for the year to a Yokohama silk merchant, obtaining in return a documentary bill issued by a Yokohama bank on behalf of the silk merchant. At this stage, the merchant would then either make a working capital loan to the silk reeler directly, or the silk reeler would obtain such a loan from his regional bank against presentation of the documentary bill. This advance on the documentary bill would allow the reeler to purchase cocoons and to reel

[7] In particular, in the early stages of the industry's development, there was no direct access to these prefectures via railway.

the silk. A couple of months later, once the silk had been reeled and transported to Yokohama, the Yokohama bank would issue a bill of acceptance to the reeler, who would then be able to fully discount the documentary bill with his regional bank, thus obtaining final payment for the merchandise and clearing the working capital loan received earlier. The regional bank would then settle payment of the documentary bill with the Yokohama bank, which would, in turn, pass the silk on to the merchant after receiving payment.

In this system, while the Yokohama wholesalers would refinance themselves from city banks in Yokohama, or directly based on promissory notes discounted by the Bank of Japan, the Yokohama banks would generally not lend to the reelers directly. As Nakabayashi emphasizes, it was therefore the wholesaler who ultimately had to screen the quality of the borrower, i.e. the silk reeling firms. Conversely, the regional banks mainly acted as local intermediaries and, essentially, clearing houses for the documentary bills issued by Yokohama banks on behalf of the silk merchants.[8]

The financing institutions of the silk trade were in fact very similar to the modern institutions of export finance as they have recently been described in e.g. Amiti and Weinstein (2011). In the terminology of export finance, the regional banks acted as the 'advising' bank of the silk reeler (the 'exporter'). The Yokohama banks acted as 'issuing' banks for 'letters of credit' (the documentary bills) drawn on the Yokohama merchant (the 'importer').[9] Very much like modern export finance, this system was designed to overcome the many possible frictions that could occur in any stage of the process: the financing friction faced by the silk reeler who needed working capital to produce silk, the infor-

[8] Miwa and Ramseyer (2006) argue that, even when they started to make direct loans to the silk reelers, banks 'piggy-backed' on the informational advantage of the Yokohama silk brokers, e.g. by only complementing loans that were made by the silk brokers. Furthermore, the Yokohama merchants themselves were also often involved in the foundation of the regional banks or had substantial shareholdings in them. See also Naito (2008) for a detailed case study of the emergence of local banks in the silk reeling regions.

[9] In this context, it is important to note that, as a treaty port, Yokohama was an almost extraterritorial market for silk in which the silk merchants acted as *de facto* importers. Once in Yokohama, the silk would usually be sold on directly to the foreign trading companies, whose representatives were not allowed to source silk outside Yokohama directly. Nakabayashi (2014) studies the price dynamics for silk in the Yokohama market and the New York market, showing that these two markets were very highly integrated. Hence, market segmentation mainly existed between the Yokohama market and the silk-producing regions within Japan, and the Yokohama silk merchants acted as export intermediaries for the many small silk reeling firms. The importance of such trade intermediaries in modern-day emerging markets such as China has recently also been emphasized by Ahn et al. (2011).

mational friction arising from the uncertainty about the quality of the silk the reeler might produce, the risk of damage to the silk during transport from remote prefectures such as Nagano and Gifu to the port of Yokohama and, finally, the possibility of the silk merchant failing to pay for the silk upon its arrival in Yokohama.[10]

Like modern export finance, this system allowed the 'advising' banks in the silk region to remain predominantly local: the bank raised deposits locally and lent locally to the silk reelers. In this system, international (or out-of-region) transactions by the local banks could remain limited to the settlement of the documentary bills with the Yokohama banks. Hence, the Yokohama banks, from the outset, transacted with local banks in many prefectures—they were financially integrated with the whole country. Conversely, local banks in the silk reeling regions could remain predominantly regional.

The growth of the silk industry is a case in point for a literature that has emphasized that access to trade credit is an important driver of industry growth when financial development is low and bank finance is not available (Petersen and Rajan (1997) and Fisman and Love (2003)). We go beyond these papers in arguing that relatively easy access to trade credit through the Yokohama silk brokers also had an important feedback effect on the development of the banking system in the silk reeling regions.

The informational advantages that come with trade credit relationships (see Petersen and Rajan (1997)) also provide a related but distinct explanation for why the banking system in the silk regions developed very much along regional lines. As we have argued, mechanization was important for improving quality and for competing in the US market. However, mechanization also led to a separation of cocoon growing from silk reeling, thus making trade credit for working capital a necessity. Silk reelers reacted to this challenge by forming regional cooperatives. These cooperatives were at the

[10] Note that this system did not require the Yokohama banks that issued the letters of credit to acquire much information about individual exporters. It was the Yokohama silk merchants and, as we will discuss shortly, the local banks that gathered information about the quality of individual silk reelers. It is conceivable that this network of local lending relationships, with its customer base of small silk filatures, may have endowed the regional banks with an important competitive advantage relative to their nationwide competitors— even long after the silk industry had eventually declined and been displaced by other small-scale manufacturing industries. However, this network of long-standing relationships may in turn have made it difficult for these small firms to switch to nationwide, integrated lenders when credit dried up during the recession of the 1990s. We believe that this is just one possible but potentially powerful channel that illustrates how the *de facto* segmentation of banking markets may have persisted even after technology and regulation had removed any formal barriers to banking flows between prefectures.

forefront of mechanization, and they also acted as local financial intermediaries.

Specifically, cooperatives played a key role in attaining the consistent quality levels required for the US market by organizing a process called re-reeling. Japan's high humidity levels during the summer carried the risk that reeled silk would curl or get sticky during transport. Therefore, the thread was reeled a second time. Whereas the first round of reeling would usually take place in a decentralized way in the individual small reeling firms—initially often still by hand—a second round of mechanical reeling was performed centrally in larger filatures that were operated by the cooperatives. Not only did the centralized mechanical re-reeling allow small reelers to improve the quality of their silk without having to invest in mechanized filatures of their own, but the centralized reprocessing of the silk also enabled reelers' cooperatives to implement a strict quality control system (see again Nakabayashi (2006) for an excellent and detailed description). Thanks to this type of quality assurance system, Japanese silk exporters came to dominate the US market and were able to build considerable brand reputations in the New York silk market by the late 19th century. However, the quality control system also allowed the cooperatives to acquire much information about their member firms. This information, in turn, allowed the silk cooperatives to act as intermediaries and provide trade credit to their members (e.g. by providing advances on the documentary bills drawn on Yokohama merchants).

By the turn of the century, the role of the cooperatives had become so important that they were regulated by law in the first industrial cooperative act of 1900. For the first time, this law also regulated the role of industrial credit cooperatives. These industrial credit cooperatives were the direct precursors of modern-day Shinkins (cooperative banks), which (along with the Sogo—mutual—banks) are the main regional banks also in modern Japan and that we are studying here. To the present day, these cooperative and mutual banks mainly raise capital from and lend to their local membership of small businesses.

Mechanization and the development of the trade credit and export finance system fed on each other: with high-quality silk came access to the Yokohama export market and, therefore, access to trade credit. The consistent quality of the raw silk was an important part of the credit relationship

between the Yokohama silk merchants and the reelers and their cooperatives (see Nakabayashi (2006)). The most reputed producers of silk (e.g. the *Kaimeisha* cooperative from the Suwa district, Japan's silk heartland, in Nagano prefecture) also had access to the most reputed Yokohama silk merchants—those with the best refinancing options.[11] Access to trade credit (and export finance) fostered the growth of the silk industry, and it was the most reputed, high-quality reelers who came to dominate the export market.

4 Evidence of long-term persistence

We argue that the system of trade credit and export finance of the silk industry came to perpetuate itself, leading silk regions to develop a banking sector that was largely regional and in which large regionally integrated banks played, and continue to play, a relatively limited role.[12] Hence, our main empirical claim is that the local banking market structure that developed as response to the financing needs of the silk industry in the late 19th century effectively persisted for a century. Figure 1 provides first-hand evidence of this long-run persistence. It plots the (logarithmic) number of filatures per head in 1895 against the average prefecture-level lending share between 1980 and 1990 of regional(sogo and Shinkin) and city banks. There is a clear positive relation between regional bank lending shares and the number of silk filatures per capita in 1895, whereas the link is clearly negative for city banks.

Table 1 presents our main results by providing a further analysis of this link. The coefficient of a regression of lending shares on silk filatures is significant for all three bank types (city, sogo and shinkin). We also run the same regression with a set of controls: the pre-1990 relative GDP of a

[11] There were different strata of wholesalers. The most reputed wholesalers could refinance themselves directly from the Bank of Japan and Japan's export bank, the Yokohama Specie Bank. A second tier of wholesalers would refinance themselves only through the private city banks (see Nakabayashi (2014)).

[12] Miwa and Ramseyer (2006) emphasize the role of trade credit and cooperative structures in providing working capital for the silk reeling industry. They contrast this with the cotton reeling industry: cotton mills were hugely capital intensive, and many of them actually raised capital on the new stock exchanges and imported much modern machinery. Not so silk reeling. This industry remained relatively labor intensive and was highly fragmented, characterized by many small firms. As Miwa and Ramseyer (2006) note, none of the 40 firms listed on the Osaka stock exchange in 1900 were in the silk industry.

prefecture, a dummy for the core prefectures (Greater Tokyo, comprising Tokyo, Chiba, Kanagawa and Saitama; the Kansai region, comprising Osaka, Hyogo and Kyoto; and Aichi) and the (logarithmic) distance to Yokohama, as the first and biggest open port. The link between the importance of silk reeling and lending shares remains unaffected by these controls, and the individual t-statistics in the regressions with controls are all greater than four in absolute value.

The last set of columns in Table 1 also report regressions of indicators of a prefecture's general level of financial development on our silk instrument, again with and without controls. There is no significant link between silk and the density of bank branches in a region. Total lending relative to GDP is negatively correlated with the instrument, but it is much less significant than in the regressions for the integration indicators. Once we also include our financial integration measure, silk becomes insignificant in the regression for lending/GDP. This suggests that lending/GDP is correlated with silk mainly via the correlation with regional financial integration.[13] We think that these findings are important for the interpretation of our results: the silk regions were not necessarily financially less developed than other regions at the onset of the recession of the 1990s. Instead, we are claiming that the silk regions embarked on a path to financial development that was strongly influenced by the specific institutions of trade and export finance in the silk industry. For the reasons discussed above, this led silk regions to adopt a financial system characterized by regional, cooperative banks, in contrast to the nonsilk regions, in which larger, countrywide banks came to dominate the market. Both routes to development seem to have served the specific needs of the industries that developed in these regions at the time.[14] However, the regional model of banking in the silk reeling regions in the 19th century implied a lower level of *de facto* integration with the rest of the country that lasted for a century.

[13] Conversely, if we include lending/GDP in our regression for the integration indicators, it is insignificant, whereas silk is even more significant. These results are available upon request.

[14] After all, with regard to silk reeling, Japan did come to dominate the world market until silk as an industry started to decline after World War II.

Exogeneity of comparative advantage

Several concerns could be raised against our argument that a prefecture's comparative advantage in silk was causal for its financial development and for *de facto* financial integration a century later. First, access to finance may have been a precondition for the mechanization of the silk industry, not its outcome. Therefore, second, mechanization may just be one aspect of the general growth of the silk industry, which as a whole had to rely on credit for its development. We address these two issues in turn.

First, even to the extent that pre-existing differences in financial development, or other unobserved regional characteristics, may have favored the move towards mechanization, they did not directly cause it. As we have argued, it was an exogenous price shock that produced the incentives for mechanization.

Secondly, scholars of economic history who have studied industrialization during the Meiji period (1862–1912) have argued that one of the factors that favored the emergence of silk as an export staple was that silk reeling, mechanized or not, was not particularly intensive in terms of fixed capital.[15,16] In the early stages of the industry's development, it is not even clear that mechanization offered huge advantages in terms of increased productivity. In fact, mechanization made only slow progress throughout the 1860s and 1870s, in spite of significant government support aimed at the improvement of silk quality. The exogenous shock that changed this was the decline in the price of hand-woven silk in the 1880s following the French depression, coupled with the huge demand for mechanically reeled silk in the US (see Nakabayashi (2014)).[17]

[15] See e.g. Yamazawa and Yamamoto (1979), Yamazawa (1975) and Fujino et al. (1979).

[16] Even mechanized filatures are not particularly lumpy investments. In principle, what is required is a steam boiler to heat the thread at a constant temperature and water or steam power for the reeling. Even in the mechanized filatures, manual labor, not fixed capital, remained the main input. Thus, mechanization could, in principle, be afforded by even small firms or groups of silk farmers.

[17] As a prime example, Nakabayashi (2014) reports the attempt of the Meiji government to install a role-model plant in the village of Tomioka in Gunma prefecture in the 1870s. This plant was very successful in training skilled workers but did not become economically viable. Instead, it was in the Suwa area in the neighboring Nagano prefecture and in Aichi prefecture that mechanization quickly took hold in the 1880s, following the decline in the relative price of hand-woven silk.

Table 2 shows that it was not the general development of the silk sector *per se* but rather its mechanization that is closely related to the development of regional vs. city banking. In the table, we report specifications in which we regress our pre-1990 lending shares by bank type on both mechanized and hand filatures. We also consider output-related measures: i.e. we regress lending shares on the output of hand-reeled silk (so-called 'hanks') and on the output of machine-reeled silk. In all specifications and across all bank types it is apparent that it is always the variable measuring mechanization—be it the number of filatures or the machine-reeled output—that is significant, whereas the variables related to hand reeling are all insignificant for all bank types.[18] This suggests that mechanization plays a special role in explaining the link between silk and the regional fragmentation of banking markets. This is consistent with our interpretation that mechanization led to the need for trade credit because it necessitated a separation of cocoon growing and reeling and because it improved silk quality, thus signaling borrower quality to the Yokohama silk merchants.

5 Sources of long-term persistence

While our focus here is on how comparative advantage in silk has affected financial structure, the question arises how these financial structures came to persist for over a century. The idea that higher levels of financial development and better access to international financial markets may eventually foster the development of particularly finance-dependent sectors and firms (Fisman and Love (2004) and Bekaert et al. (2007)) is well-established in the economic literature. In the same vein, the silk regions' localized, cooperative model of banking could itself have been a comparative advantage that —after the decline of the silk industry, over the course of the 20th century—could have led former silk regions to specialize in certain industries because these industries would also have benefited from such

[18] Note that this result is not because of a generally very low share of hand production: on average, machine-reeled silk accounted for approximately three quarters of prefecture-level output of silk in 1895, and the range is from around five percent to more than 90 percent. Hence, in many prefectures, a significant share of output continued to be reeled by hand. Note also that the cross-sectional correlation between the prefecture-level output of hand-reeled and machine-reeled silk is quite low: no higher than 0.3.

a localized banking system. While this channel could potentially explain why the localized banking structure may have persisted for a century, it would also challenge the view that comparative advantage in silk itself ultimately caused the persistent, century-long local segmentation of Japan's banking markets. In this section, we therefore explore the nexus between financial and industry structure in more detail.

In Table 3, we regress our measures o modern-day industrial structure— the total share of manufacaturing and of small manufacturing firms in prefectural GDP—on the total number of filatures per head of population and a set of controls. Indeed, this link is highly significant and positive; the old silk regions are particularly manufacturing intensive today. However, as we show next, silk has affected the rise of a large manufacturing sector with many small firms through channels other than finance. In fact, it is well documented in the literature, that, as hosts to Japan's first large export industry, silk reeling prefectures served as a nucleus for the development of manufacturing know-how, notably in the machinery sector.[19] As Japan learned to produce and export high-quality silk, it also developed its manufacturing sector.[20] We exploit this insight to separate the long-term impact of silk production on manufacturing from that on finance. Specifically, we conjecture that interindustry (Jacobian) externalities that may lead to the emergence of manufacturing clusters are a direct function of proximity. Therefore, we use a prefecture's minimum distance to one of the four prefectures with the highest number of mechanized filatures in 1895 (Kyoto, Nagano, Gifu and Shizuoka) as an exogenous shifter of modern-day industrial structure.

The remaining columns of Table 3 show that this identification assumption is justified empirically: once we include the logarithmic distance to the main (mechanized) silk regions as an additional regressor along with the (logarithmic) number of total filatures per head, we can disentangle the two effects quite clearly. In the regression where industry structure is the dependent variable, the distance variable has a much larger coefficient than does the number of filatures per head, and it is also much

[19] See e.g. Yamazawa (1975), Ma (2004), Nakabayashi (2006) and Atsumi (2010).

[20] This view is consistent with the role of interindustry spillovers emphasized by Glaeser et al. (1992). Specifically, Jacobian (i.e. interindustry) externalities tend to be particularly important in the early stages of an industry's development.

more highly significant. Conversely, where our financial integration measure is the dependent variable, the picture is exactly the opposite: the coefficient of distance is small and insignificant, whereas that of the number of filatures is both large and significant. This suggests we can use the logarithmic distance to the main silk areas as an indicator of growth expectations in the late 19th century and as an instrument for the role of manufacturing (and credit dependence) at the end of the 20th century. Conversely, we continue to find a strong link between the number of filatures per capita and banking sector integration during the 1980s.[21]

These results suggest that the long-term persistence of local credit market segmentation was not primarily driven by the subsequent development of a prefecture's industrial structure. Consisten with the earlier literature, silk definitely impacted long-term industrial structure, e.g. through inter-industry spillovers . But the local prevalence of the silk-industry seems to have had an independent persistent effect on banking market segmentation that survives controlling for industrial structure.

Our preferred interpretation of this finding is that political and regulatory factors were behind the century-long persistence of geographical segmentation in Japan's banking markets. While a national banking market had started to develop during the late 19th century, regional banking integration in the prewar era remained limited due to very anticompetitive regulation (Grossman and Imai (2008)). Even though the 1927 bank law stipulated mergers of small banks, under the pressure of local elites, most of these mergers happened along regional lines (Okazaki and Sawada (2007)). In the late 1930s, finance minister Eiichi Baba explicitly declared the goal of one "prefecture — one bank", so that there were a lot of mergers between banks at the regional level, but, importantly, almost none across prefectural borders (Hoshi (1995)). During the postwar era and well into the 1990s, government regulation under the convoy system then restricted regional banks from opening branch networks outside their prefecture of origin (see Hoshi and Kashyap (2000) and Hosono et al. (2007) for details).

[21] Our line of argument is similar to that of Acemoglu and Johnson (2005), who, in a different setting, report that both colonial settler mortality and English legal origin individually have prognostic power for measures of property rights and contracting institutions today. However, when both are included as regressors simultaneously, English legal origin mainly affects contracting institutions whereas settler mortality affects property rights but not contracting institutions.

6 Conclusion

The literature has given relatively little attention to the question to what extent comparative advantage affects financial development and the degree of financial integration of a country or region into the world economy. In this paper we shed new light on this question by exploiting the historical opening of Japan for international trade as an identifying shock.

Specifically, we have shown that prefectures with a comparative advantage in sillk reeling in the late 19th century developed a banking system focused on local, cooperative banks. For exogenous reasons such as climate and the need to source cocoons, the silk reeling industry was located in the mountain areas of central Japan. The main market for silk was in the port of Yokohama. Silk reeling was heavily dependent on trade credit because cocoons had to be bought after harvest in spring or early summer, whereas the reeled silk thread could only be shipped to Yokohama a couple of months later. The many small firms in the silk reeling industry could not, however, borrow directly from the larger banks in the major port cities. Instead, silk finance was largely provided by small regional, often cooperative banks who made operating loans against so-called 'documentary bills' issued by larger Yokohama banks on behalf of reputed Yokohama silk dealers. Therefore, regional banks provided a loan for which the Yokohama merchant was ultimately liable, and it was ultimately the Yokohama silk merchants who had to monitor the quality of the credit relation with the silk reelers. In this system, which shares many features with the institutions of modern export finance, the regional banks remained heavily focused on their regions of origin long after the eventual decline of the silk industry: the banks raised deposits locally and lent locally to the silk reelers. International (or out-of-region) transactions by the local banks remained limited to the settlement of the documentary bills with the Yokohama banks. Hence, the Yokohama banks, from the outset, transacted with local banks in many prefectures—they were financially integrated with the whole country. Conversely, local banks in the silk reeling regions remained predominantly regional. To a large extent, the regional tiering of Japan's banking system in modern times has its origins in this particular system of export finance in the silk sector.

We find that the prefecture-level number of silk reeling mills in the late 19th century is indeed a powerful predictor of the prefecture-level market share of these local lenders (as opposed to city banks) 100 years later, at the onset of Japan's Lost Decade of the 1990s. This long-term correlation is robust to controlling for the long-run impact that silk had on the industrial structure of the local economy.

Hence, comparative advantage in silk reeling was causal for the emergence of a banking system dominated by small, cooperative relationship lenders. The local cooperative banking structure served the silk regions well in the sense that it facilitated the transition towards an industry structure dominated by small-medium sized manufacturing enterprises. By the late 20th century, the silk prefectures were indistinguishable from other regions in terms of their general level of financial development. But the local nature of cooperative banks meant that comparative advantage in silk ultimately also caused long-term segmentation in banking markets. Thus, our findings illustrate that regional differences in *de facto* financial integration can be the outcome of different historical pathways to financial development and that comparative advantage can effect the financial structure of an economy over very long periods.

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Table 1: Modern day (pre-1990) lending and silk filatures

	Financial Integration						Financial Development				
	pre-1990 share in prefecture-level lending by										
	City Banks		Regional Banks				$\frac{bank\ branches}{population \times area}$		Lending/GDP		
			All (Shinkin+Sogo)		Shinkins only		(pre-1990)		(pre-1990)		
filatures / population	-0.03	-0.04	0.03	0.03	0.04	0.04	0.01	0.01	-0.61	-0.55	-0.10
(log #)	(-3.14)	(-4.70)	(4.22)	(4.11)	(4.96)	(4.53)	(0.87)	(0.87)	(-1.78)	(-1.95)	(-0.29)
Relative GDP (pre-90)		0.19		-0.01		-0.01		0.09		8.56	6.27
		(3.32)		(-0.18)		(-0.24)		(1.68)		(4.21)	(2.88)
Core Dummy		0.07		-0.001		0.02		-0.02		1.92	1.06
		(2.46)		(-0.02)		(0.71)		(-0.57)		(1.88)	(1.02)
Distance to Yokohama		-0.02		0.01		-0.01		0.01		0.55	0.74
(log)		(-1.33)		(0.66)		(-0.93)		(0.74)		(1.25)	(1.75)
City Bank Lending											12.20
											(2.28)
R^2	0.18	0.60	0.29	0.30	0.36	0.40	0.02	0.08	0.07	0.46	0.53

The Table shows regressions of modern-day (pre-1990) average prefectural lending shares by bank type (left panel) and of various (pre-1990) financial development indicators (right panel) on the number of filatures per head of population in a prefecture in 1895. The control variables are relative (pre-199) per capita GDP, the (log) distance to Yokohama and a dummy for the core areas (Tokyo, Osaka, Aichi, Kanagawa, Chiba, Saitama, Hyogo and Kyoto prefectures), t-statistics in parentheses.

Table 2: Mechanization in silk reeling (1895) and regional banking integration in the 1980s.

	FI =Share in prefecture-level lending by					
	City Banks		Regional Banks			
			All (Shinkin+Sogo)		Shinkins only	
hand filatures	-0.01		0.01		-0.00	
(log #)	(-1.35)		(0.98)		(-0.07)	
mechanized filatures	-0.02		0.02		0.03	
(log #)	(-3.57)		(3.07)		(4.28)	
output: hand reeled		-0.00		-0.00		-0.01
(log tons)		(-0.49)		(-0.51)		(-0.64)
output: machine reeled		-0.03		0.02		0.02
(log tons)		(-3.98)		(2.96)		(2.45)
R^2	0.60	0.60	0.24	0.20	0.39	0.23
Controls	yes	yes	yes	yes	yes	yes

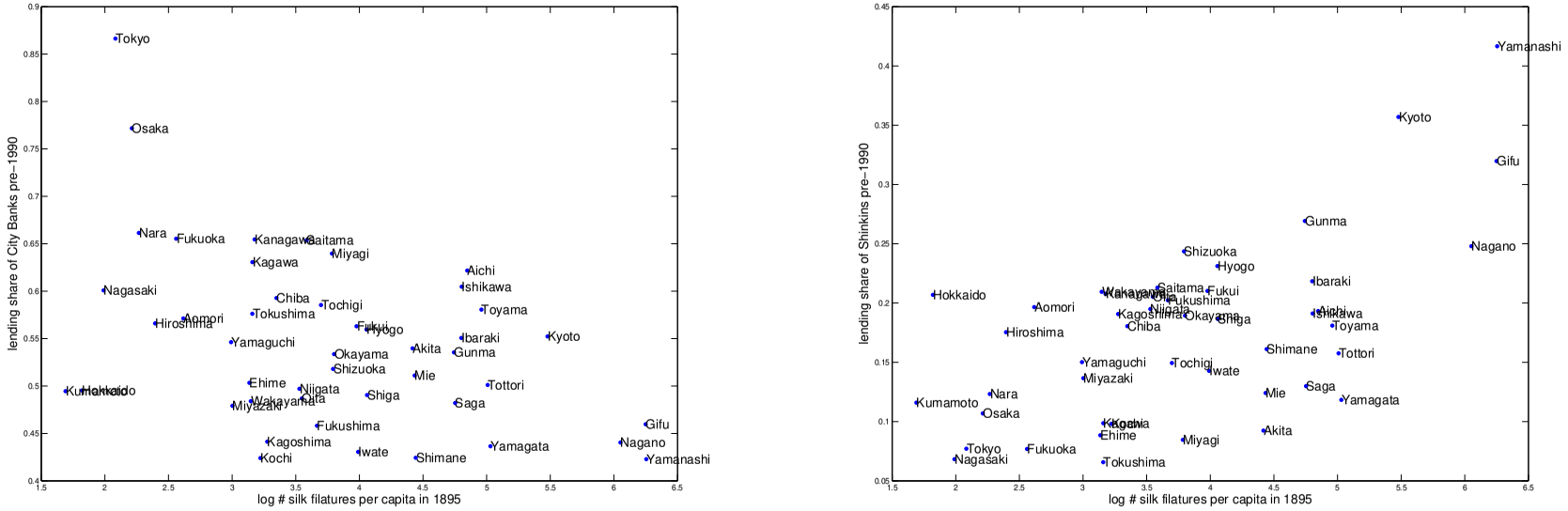
The Table shows results from regression of pre-1991 (1980-90) average prefectural lending shares by bank type on various silk industry characteristics in 1895: the number of hand-powered and machine filatures at prefecture-level, and the output of hand-powered and machine filatures respectively. Controls are: relative GDP pre-1990, a core area dummy and log distance to Yokohama. Core areas are as described in previous tables. t-statistics appear in parentheses.

Table 3: Disentangling financial integration & industrial structure

	Industrial structure				Financial Integration		
	Small manufacturing firm share		Manufacturing Share		pre-1990 lending share by		
					City Banks	Regional Banks	
	in GDP	in EMP	in GDP	in EMP		All	Shinkin
distance to most highly mechanized	-0.03	-0.02	-0.06	-0.03	-0.02	-0.01	-0.01
silk regions (log)	(-6.28)	(-5.41)	(-5.05)	(-5.26)	(-1.35)	(-1.46)	(-1.07)
filatures / population	0.01	0.01	0.00	0.01	-0.04	0.02	0.03
(log #)	(2.04)	(2.87)	(0.31)	(1.87)	(-4.41)	(3.09)	(3.60)
Core Dummy	-0.03	-0.03	-0.05	-0.03	0.08	-0.01	0.01
	(-2.30)	(-2.77)	(-1.39)	(-1.77)	(2.53)	(-0.46)	(0.37)
Distance to Yokohama	-0.01	-0.01	-0.03	-0.02	-0.03	0.01	-0.01
(log)	(-1.68)	(-1.61)	(-2.03)	(-2.32)	(-1.96)	(1.01)	(-0.70)
R^2	0.69	0.68	0.57	0.65	0.56	0.34	0.42

The Table shows cross-sectional regressions of modern-day (1980-90 average) industrial structure (left panel) and 1980-1990 average prefectural lending shares by bank type (right panel) on our two alternative silk-related variables: the minimum (log) distance to one of the four prefectures with the most highly mechanized silk industry in 1895 (Kyoto, Nagano, Gifu and Shizuoka) and the (log) number of filatures per head in 1895 and a set of controls. The control variables are the (log) distance to Yokohama (the main silk market) and a dummy for the Core areas (Tokyo, Osaka, Aichi, Kanagawa, Chiba, Saitama, Hyogo and Kyoto prefectures). t-statistics appear in parentheses.

Figure 1: The 'Silken Thread': prefecture-level City and Regional bank lending Shares (pre-1990 (1980-1990) averages) vs. number of silk filatures per head in 1895



NOTE: Left panel shows link for City banks, right panel for regional banks.